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Search for Higgs-boson production in association with a top-quark pair at CMS

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Summary

Higgs boson production in association with a top-quark pair (ttH) yields direct access to one of the most important Higgs boson properties: The top-Higgs Yukawa coupling. Its small cross section compared to other Higgs-boson production channels is one reason for it to still remain unobserved. Especially for a Higgs boson decaying into a bottom-quark pair the irreducible background by tt+jets production (tt) is overwhelming. A further challenge is given by the ambiguous assignment of jets to final state particles in the standard event reconstruction. Even though ttH events only feature moderately boosted top quarks and Higgs bosons, the analysis of boosted topologies greatly simplifies the combinatorial problem in reconstruction. The first results of the search for ttH production with the Higgs boson decaying into a bottom-quark pair in proton-proton collisions at a center-of-mass energy of $\sqrt{s}$ = 13 TeV recorded with the CMS experiment in 2015 relies on dedicated techniques to identify boosted event topologies and utilize jet substructure information to improve the sensitivity of the analysis. Boosted events are required to feature a single isolated lepton, a boosted hadronically decaying top-quark candidate and a boosted Higgs-boson candidate. The HEPTopTagger V2 algorithm is applied for the reconstruction of boosted hadronically decaying top quarks, while boosted Higgs bosons are reconstructed with a substructure algorithm based on a mass drop criterion and filtering. The identification of the boosted particles is based on subjet b-tagging and multivariate techniques. The working points of the boosted object selections are chosen to maximize the selection efficiency of ttH signal events and the rejection efficiency of tt background events.

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